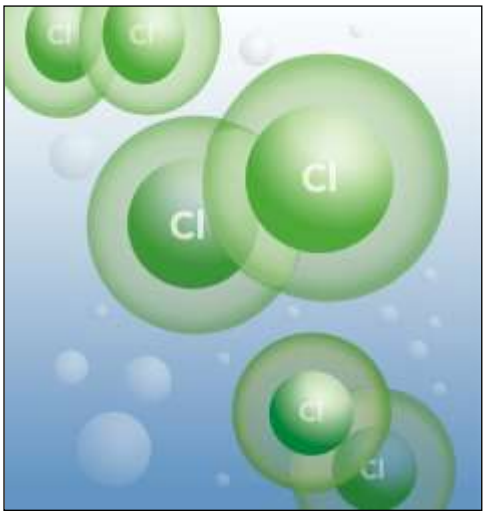
OFFICE OF RESEARCH AND DEVELOPMENT
National Homeland Security Research Center

TECHNICAL BRIEF

Use of Surrogates for *Bacillus anthracis* in the Study of Chlorine Inactivation of Bacterial Agents

Background

EPA's National Homeland Security Research Center (NHSRC), Water Infrastructure Protection Division (WIPD), headquartered in Cincinnati, Ohio, is responsible for protecting drinking water systems and sources. In carrying out these responsibilities, the NHSRC conducted research on the use of nonvirulent surrogates for *Bacillus anthracis* in inactivation studies involving chlorination.



Research

In the study currently pending publication, the NHSRC evaluated the use of *Bacillus globigi*i as a surrogate for the virulent strain *Bacillus anthracis*. The NHSRC specifically evaluated the inactivation by chlorination of *Bacillus globigii* relative to other *Bacillus* species. Recently approved legislation limits the use of *Bacillus anthracis* spores to laboratories that have governmental approval for working with select agents. These restrictions have prompted renewed interest in evaluating organisms that might serve as surrogates for the overt pathogen.

Results and Conclusions

The study compared the resistance of *B. globigii* with that of other *Bacillus* strains. The results are shown as CT values; "C" is the concentration of chlorine in milligram/liters (mgL), and "T" is exposure time in minutes. The mean CT values of *B. anthracis* Sterne, *B. cereus, B. thuringiensis* (Rice *et al.* 2005), and the virulent *B. anthracis* Ames strain (Rose et al. 2004) are shown in the following table. The mean CT values for *B. globigii* are relatively higher than the corresponding mean CT values of the three surrogates and the virulent strain, indicating that spores of *B. globigii* are more resistant than the spores of the other *Bacillus* species studied. Thus, *B. globigii* can serve as a conservative surrogate for *B. anthracis* during studies of inactivation by chlorination.

Mean CT Values for Inactivation of Spores of *Bacillus* Species

Temp °C	pH	Log 10 Inactivation	CT (mg-min/L)				
			B. globigii	*B. anthracis* Ames[a]	*B. anthracis* Sterne[b]	*B. cereus*[b]	*B. thuringiensis*[b]
25	7	2	110	79	45	41	66
		3	136	102	68	62	99
	8	2	366	ND[c]	127	132	246
		3	440	ND	191	199	369
5	7	2	370	220	140	117	229
		3	446	339	210	175	344
	8	2	965	ND	319	340	481
		3	1162	ND	478	510	721

(more)

[a] Rose, L.J., Rice, E.W, Jensen, B., Murga, R., Peterson, A., Donlan, R. M. & Arduino, M. J. 2005 “Chlorine Inactivation of Bacterial Bioterrorism Agents.” *Appl. Environ. Microbiol*. 77, 566–568.

[b]Rice, E.W., Adcock, N.J., Sivaganesan, M. & Rose, L.J. 2005 “Inactivation of Spores of *Bacillus anthracis* Sterne, *Bacillus cereus* and *Bacillus thuringiensis* var. *israelensis* by Chlorination.” *Appl*. *Environ*. *Microbiol*. (in press).

[c] Not determined

For more information, visit the NHSRC Web site at www.epa.gov/nhsrc.

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